

Measuring the Effect of Low Water Temperature on Blanking and Grain Yield

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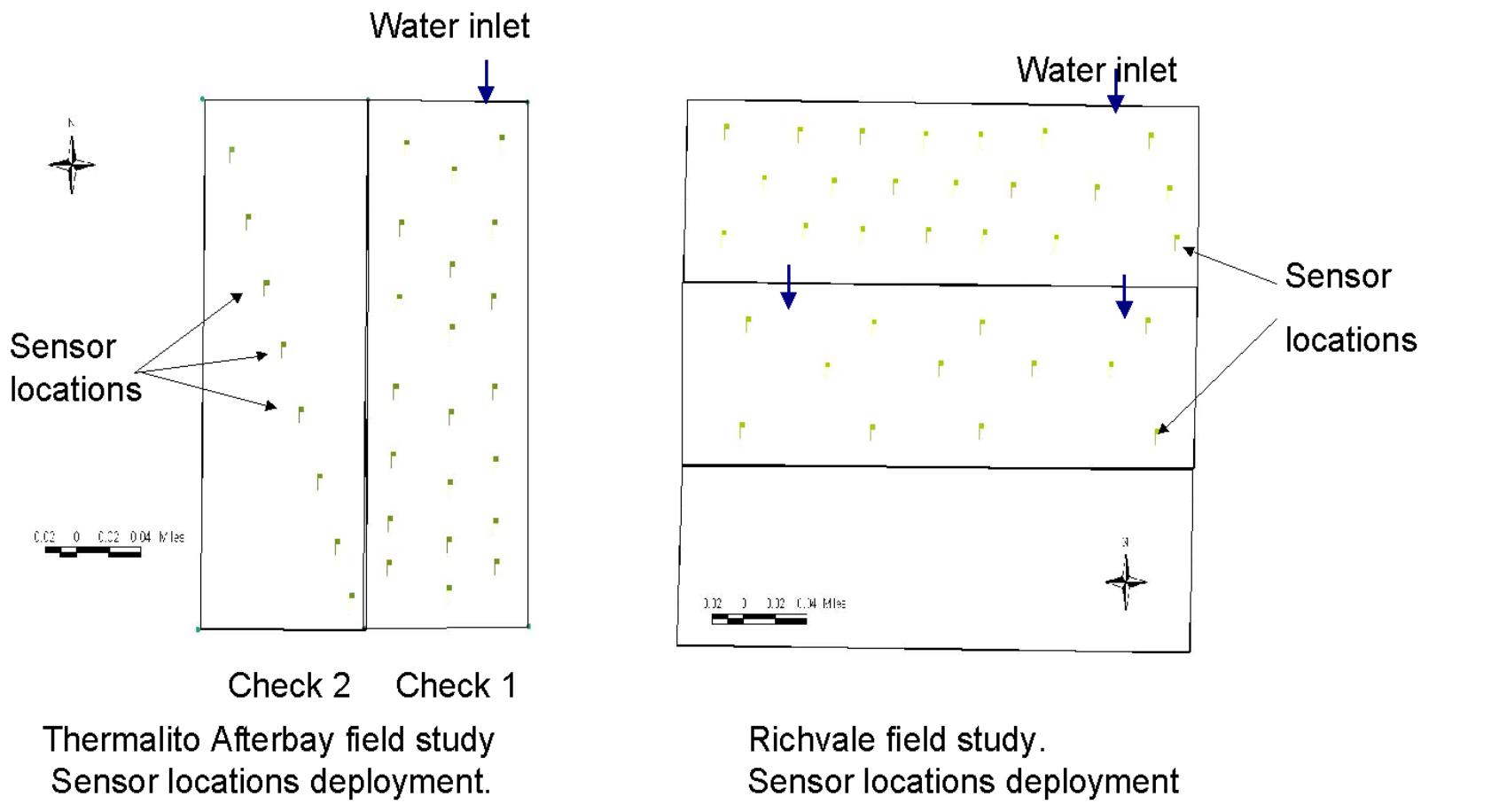
Objectives

- At the field scale
 - ✓ *Quantify the effect of low water temperature on yield*
 - ✓ *Determine causes of reduced yield due to low water temperature*
 - ✓ *Determine spatial extent of low temperature effects*
- At the regional scale
 - ✓ *Monitor water temperature throughout the irrigation district along the canal*
 - ✓ *Determine whether water temperature can be estimated by remote sensing*

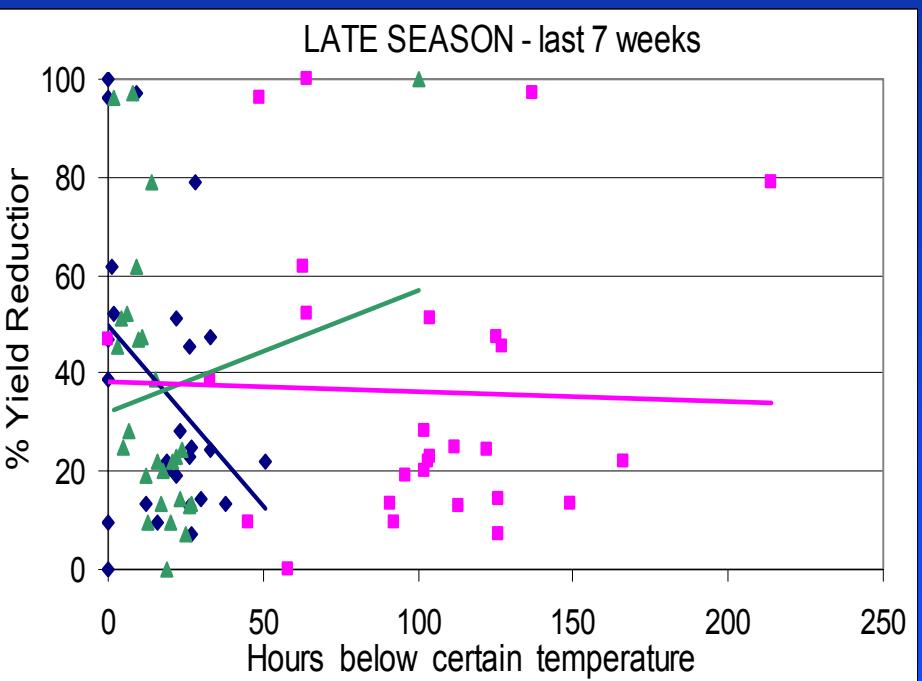
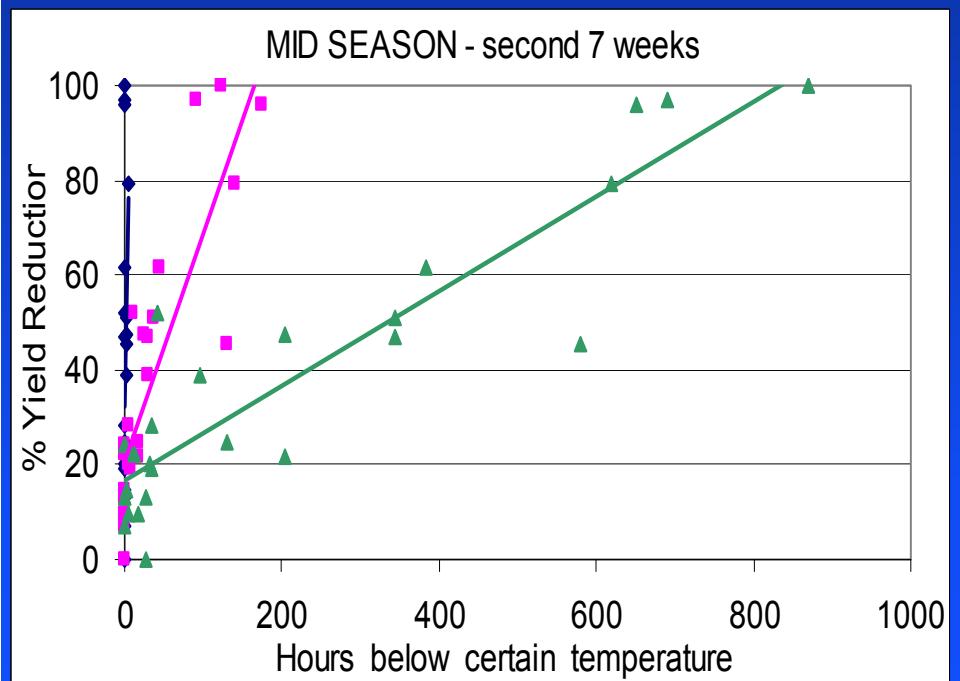
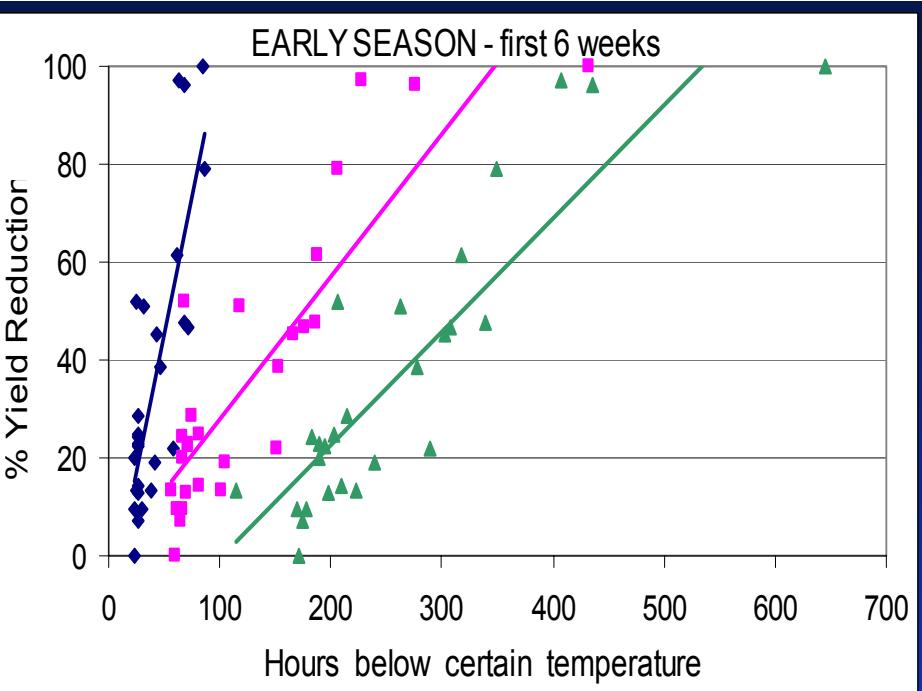
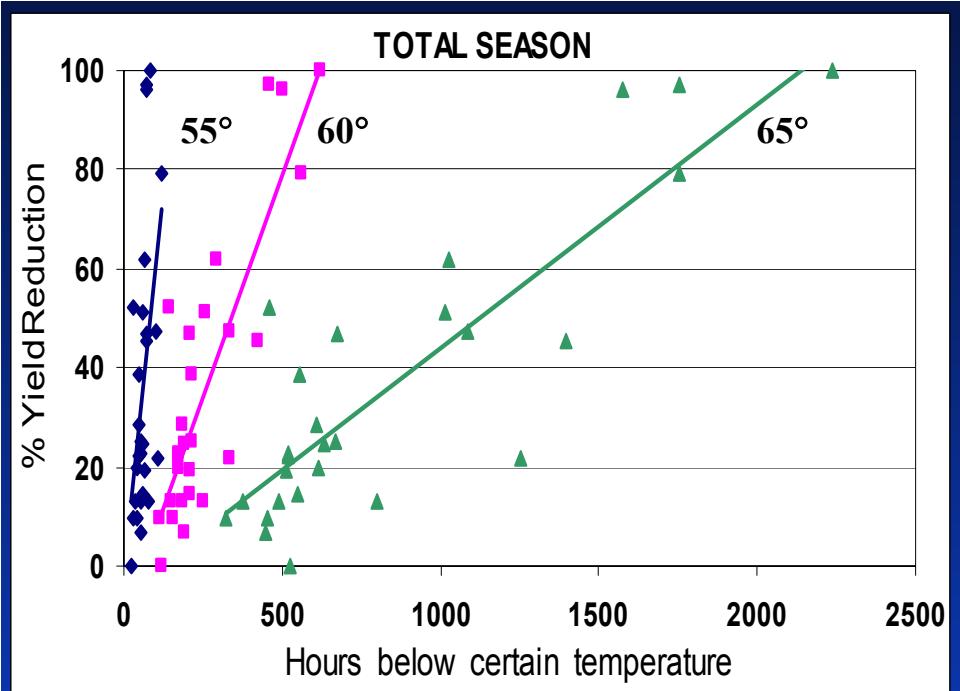
Materials and Methods

- *Place temperature sensors in a grid or transect in two fields with cold water inlets.*
- *Place temperature sensors along a canal.*
- *Acquire remotely sensed thermal images of the fields at various growth stages.*
- *Collect yield data with a yield monitor or with small plot combine at the sensor locations.*

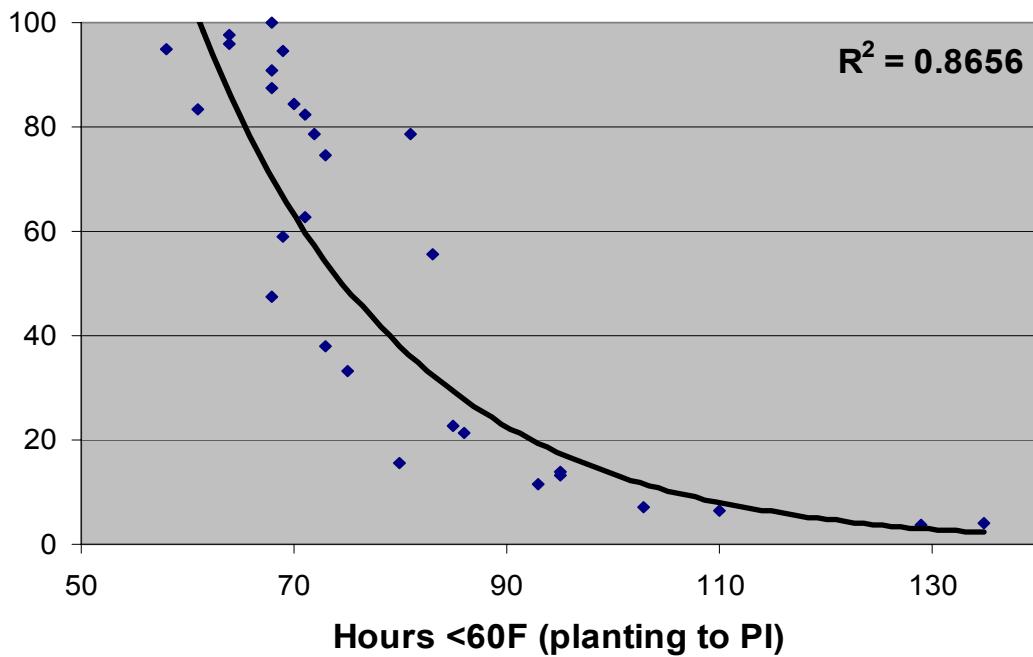
Locations of sensors within fields







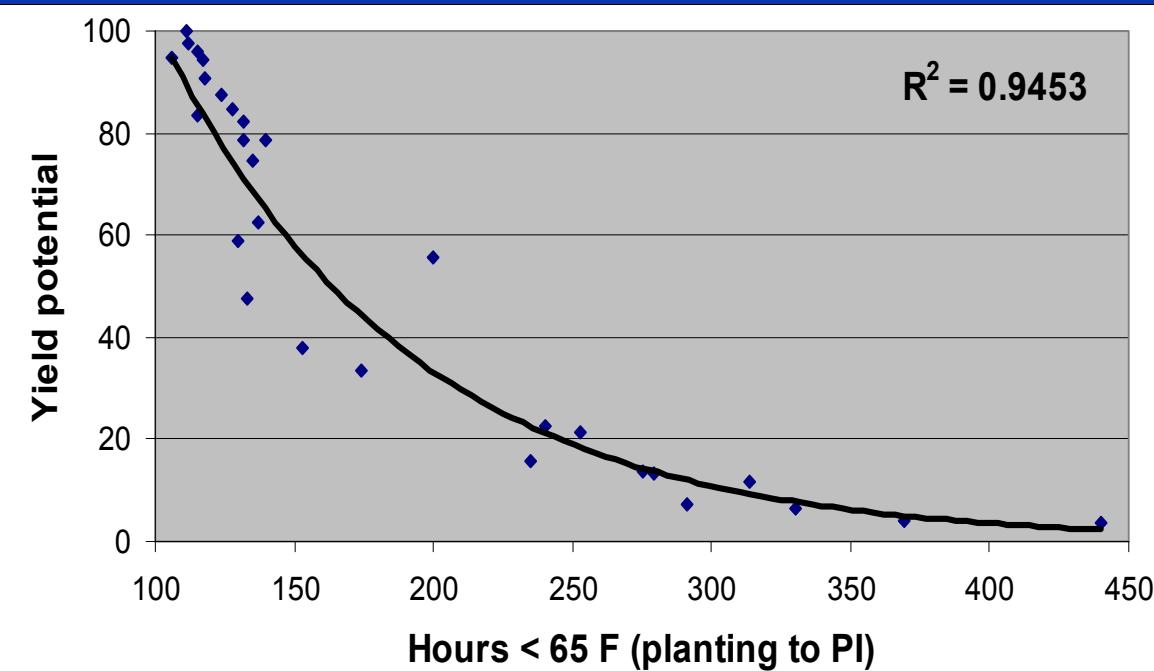
Yield potential



$R^2 = 0.8656$

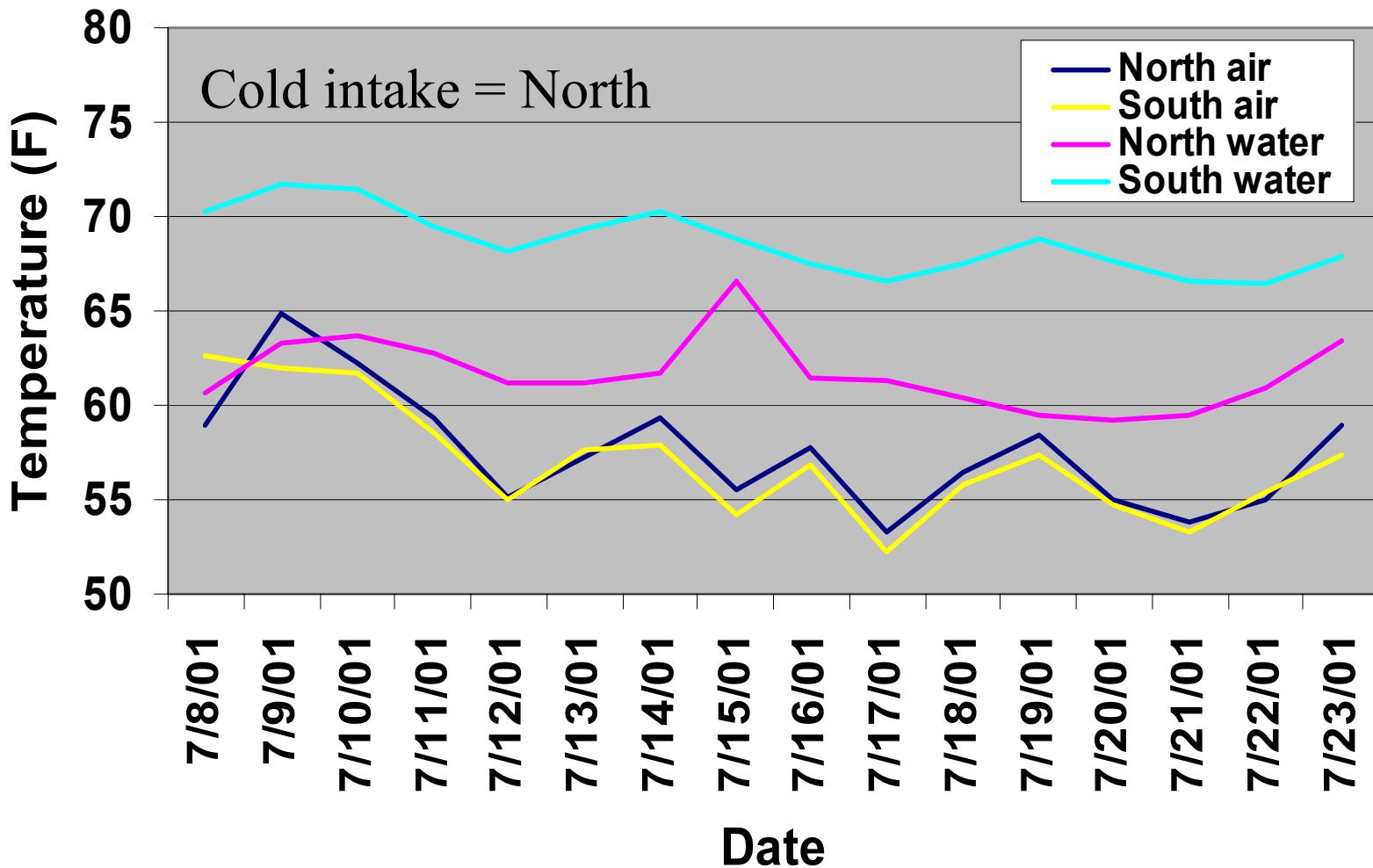
**Effect of exposure time
to cold water on yield
potential - 2002 data.**

8 AM - 4 PM PDT

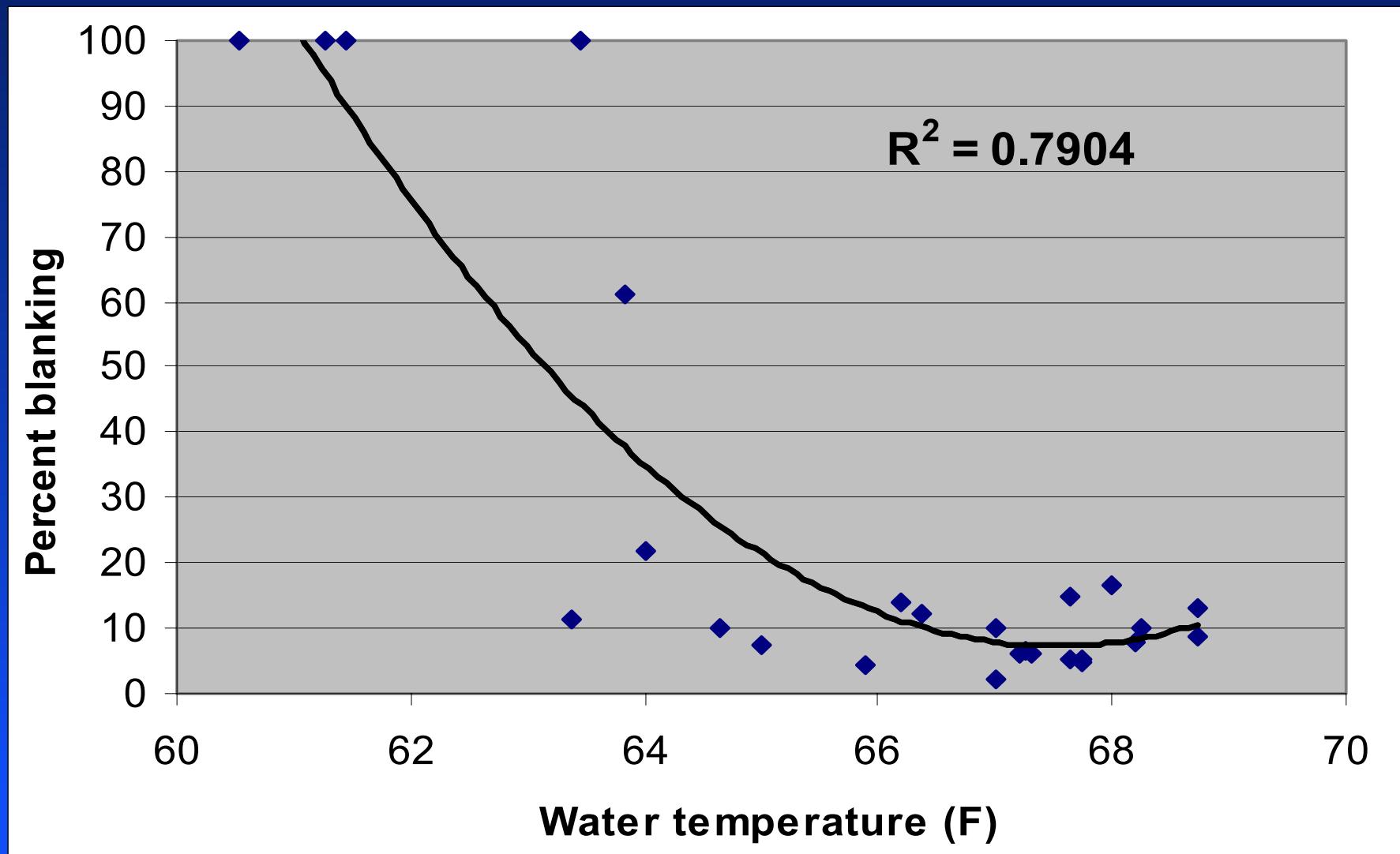


$R^2 = 0.9453$

Minimum air and water temperatures during pollen meiosis

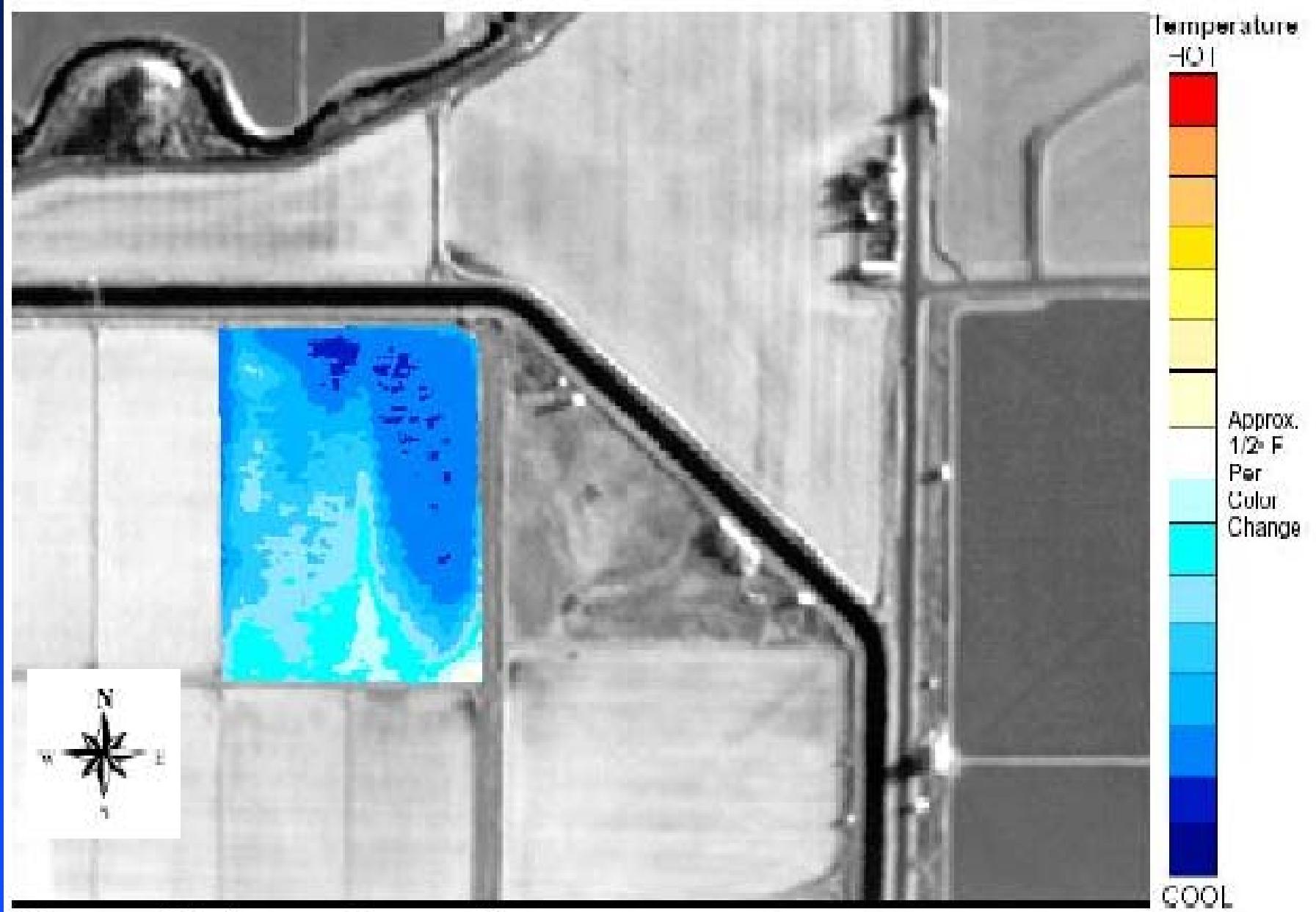


Water temperature vs. blanking

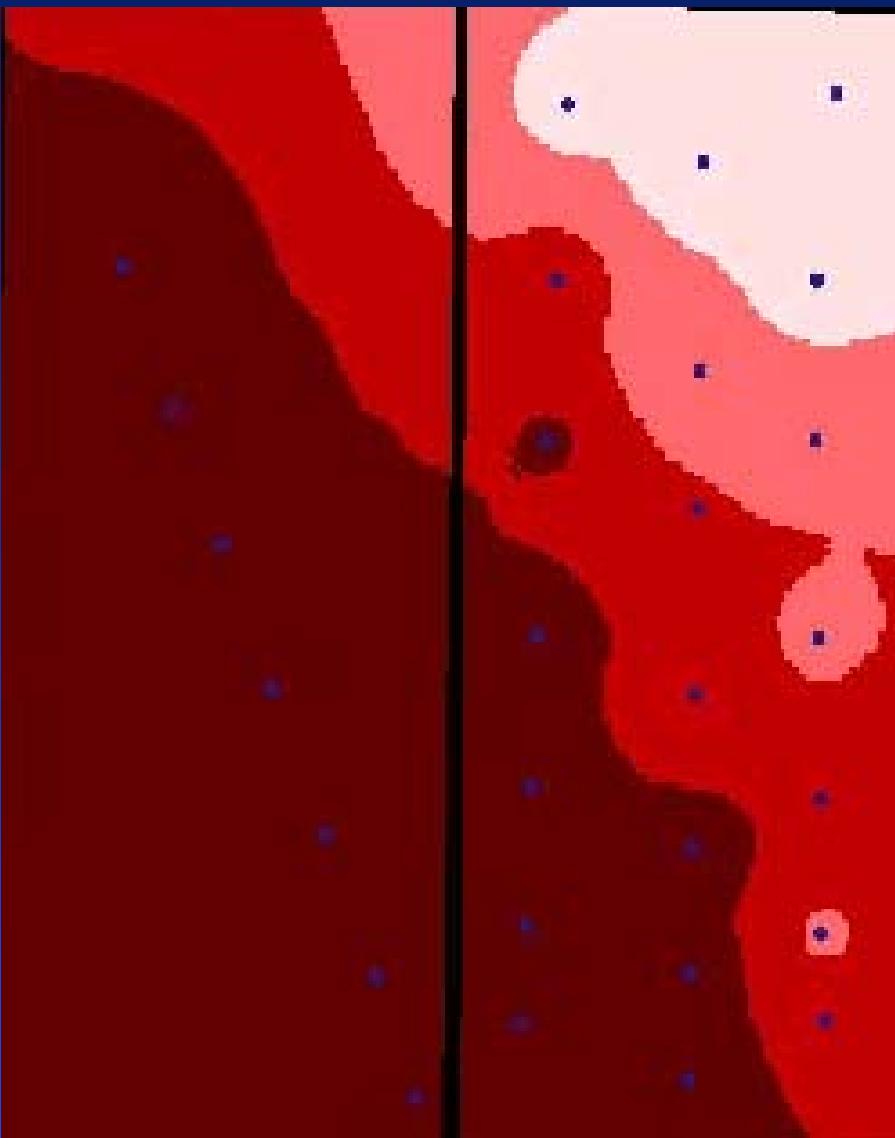




Remotely sensed thermal image



Paddy Yield (lb/acre)

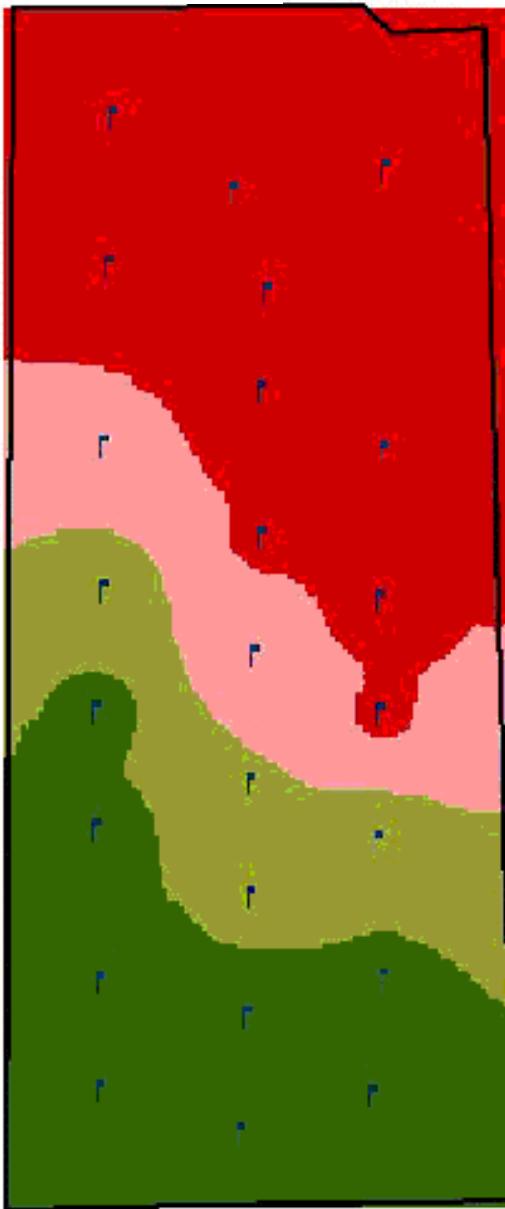


0 - 2674
2674 - 5347
5347 - 8020
8020 - 10693

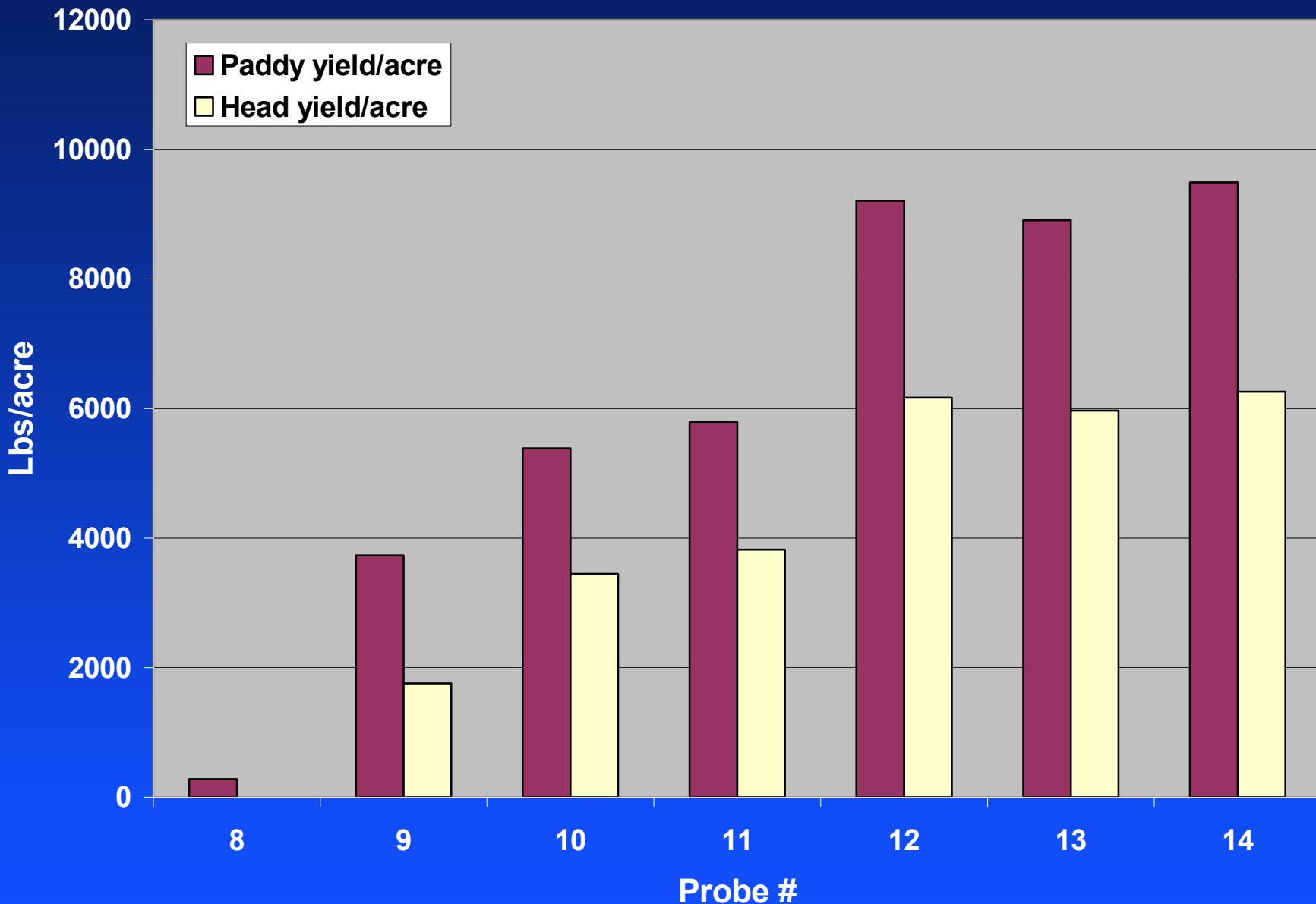
2002



- sensor location
- T1ct1.shp
- ▼ eld @14% MC (los/Ac)
- 378 723 - 2567.863
- 2567.863 - 1757.002
- 4757.002 - 6946.142
- 6946.142 - 9135.281



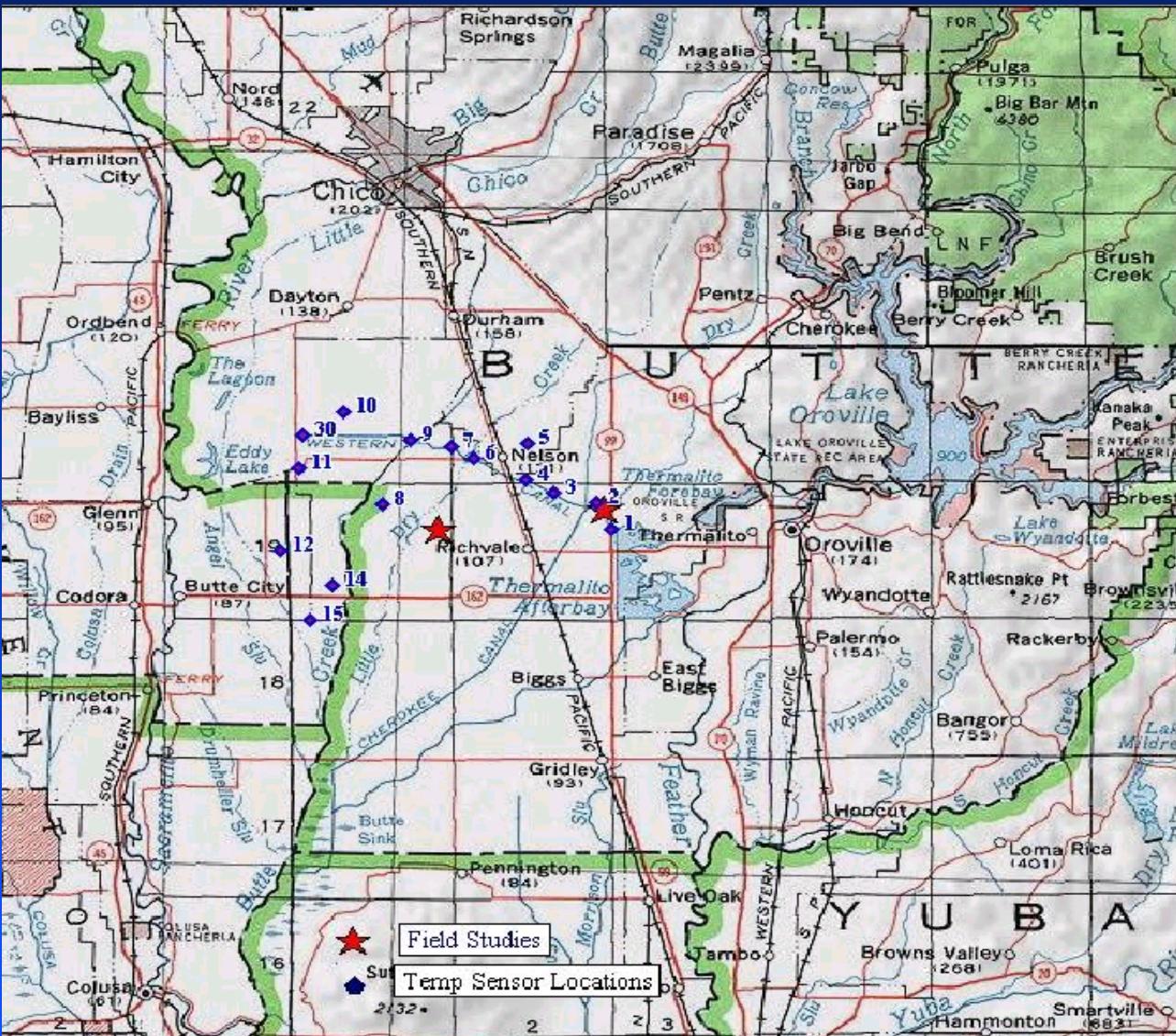
Yield – single transect



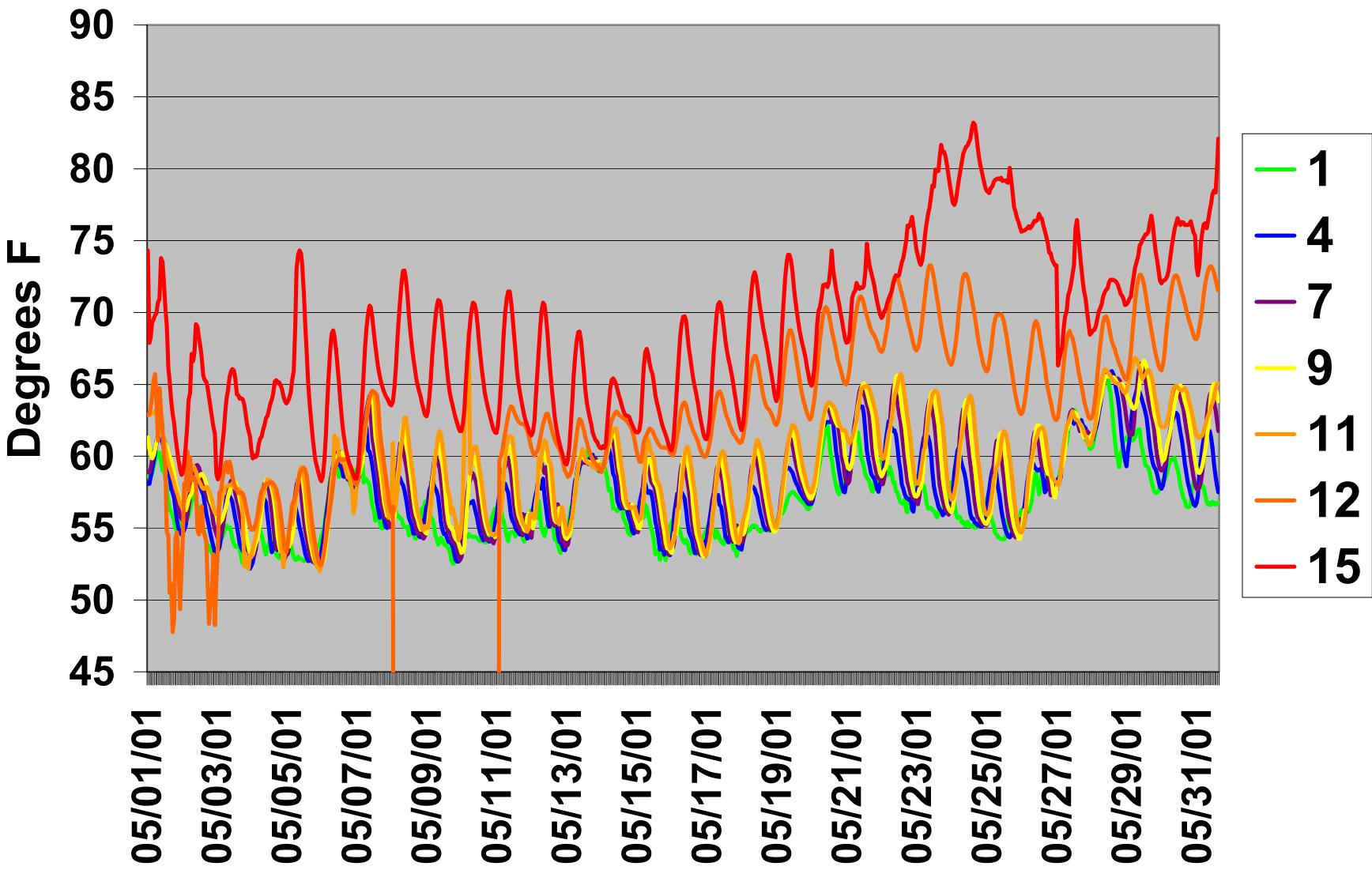
Temperature measurements along Irrigation District Main Canal



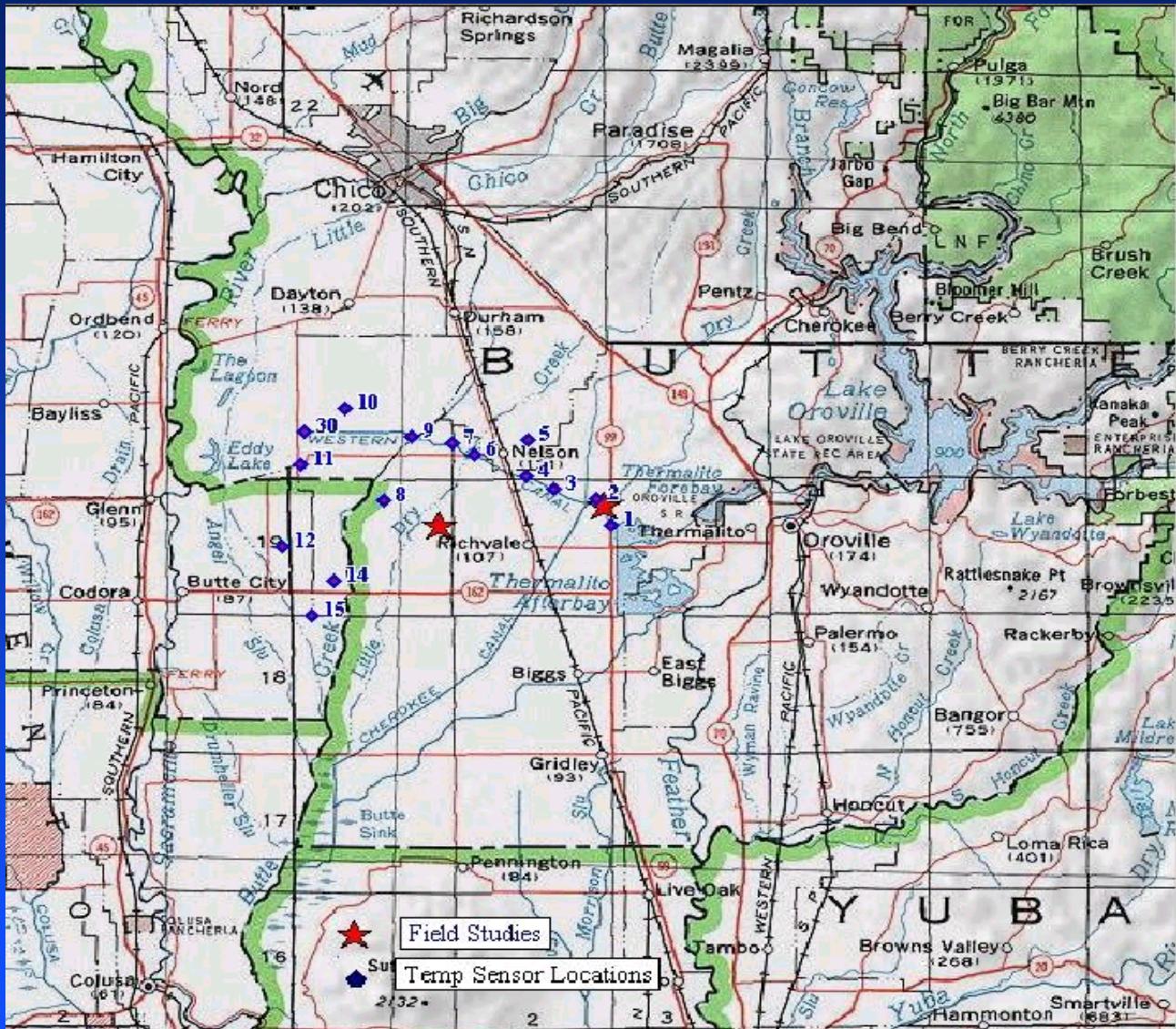
Sensor locations



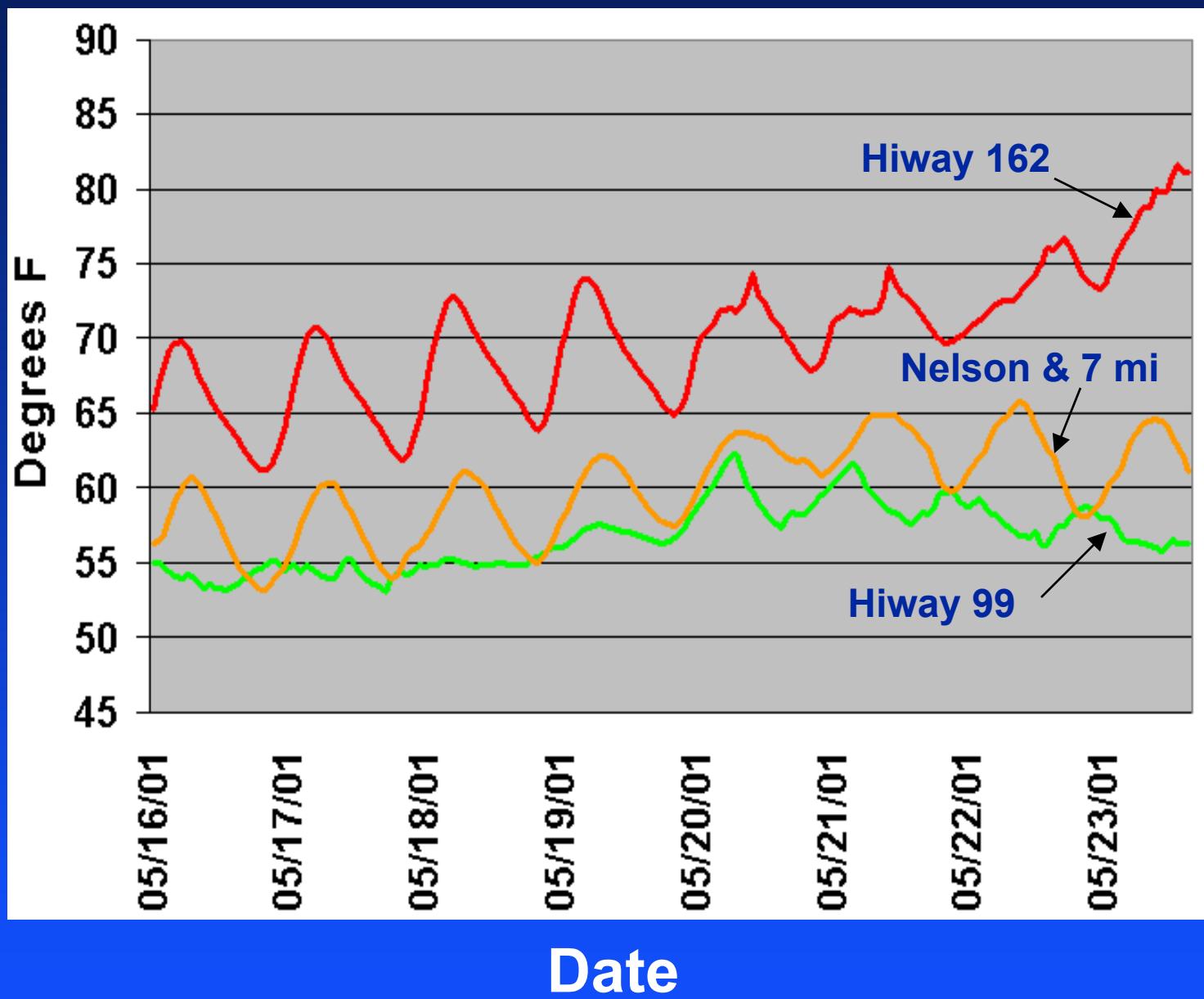
Western Canal May 2001

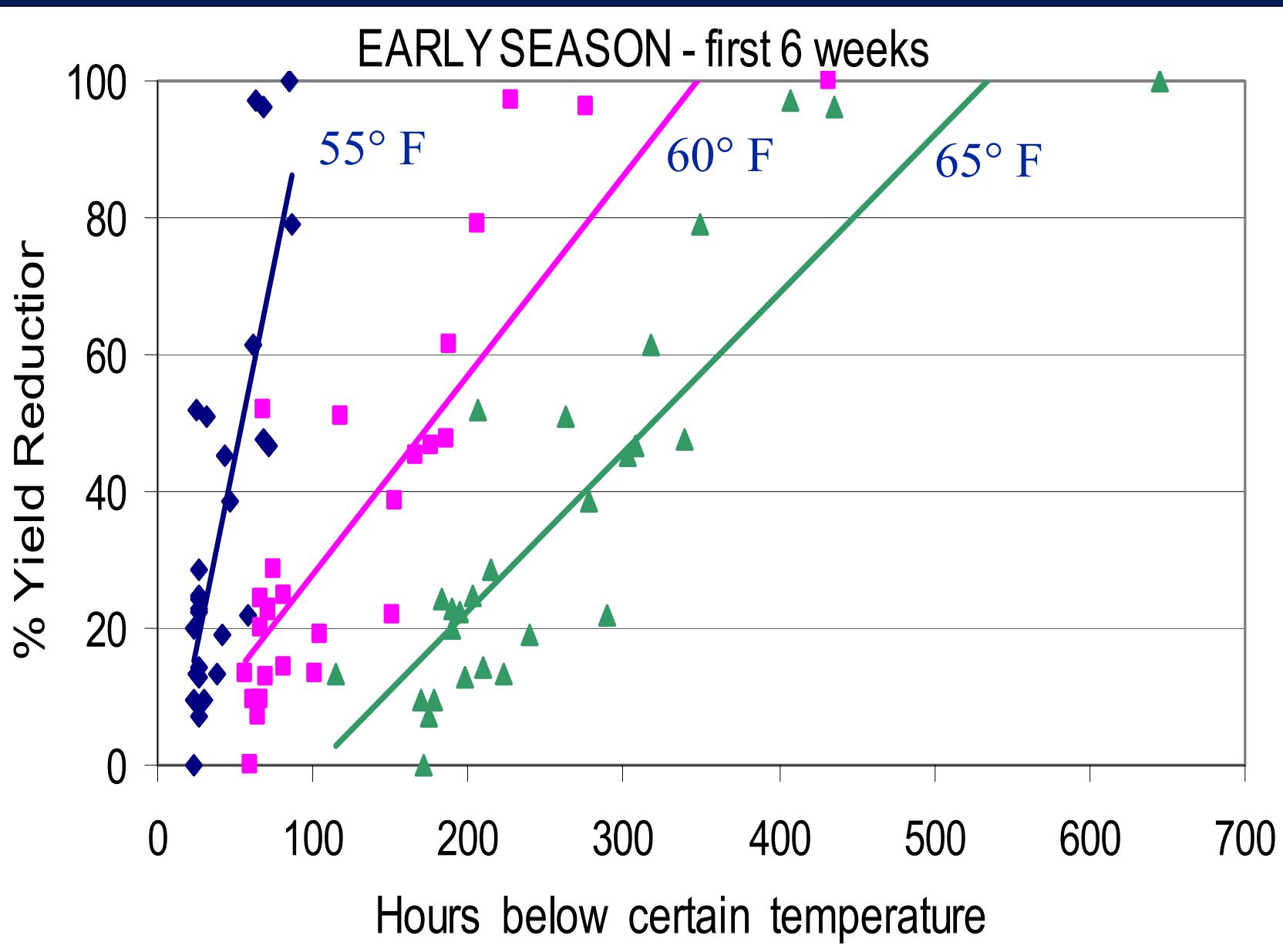


Sensor locations



Hours < 65 F
(month)

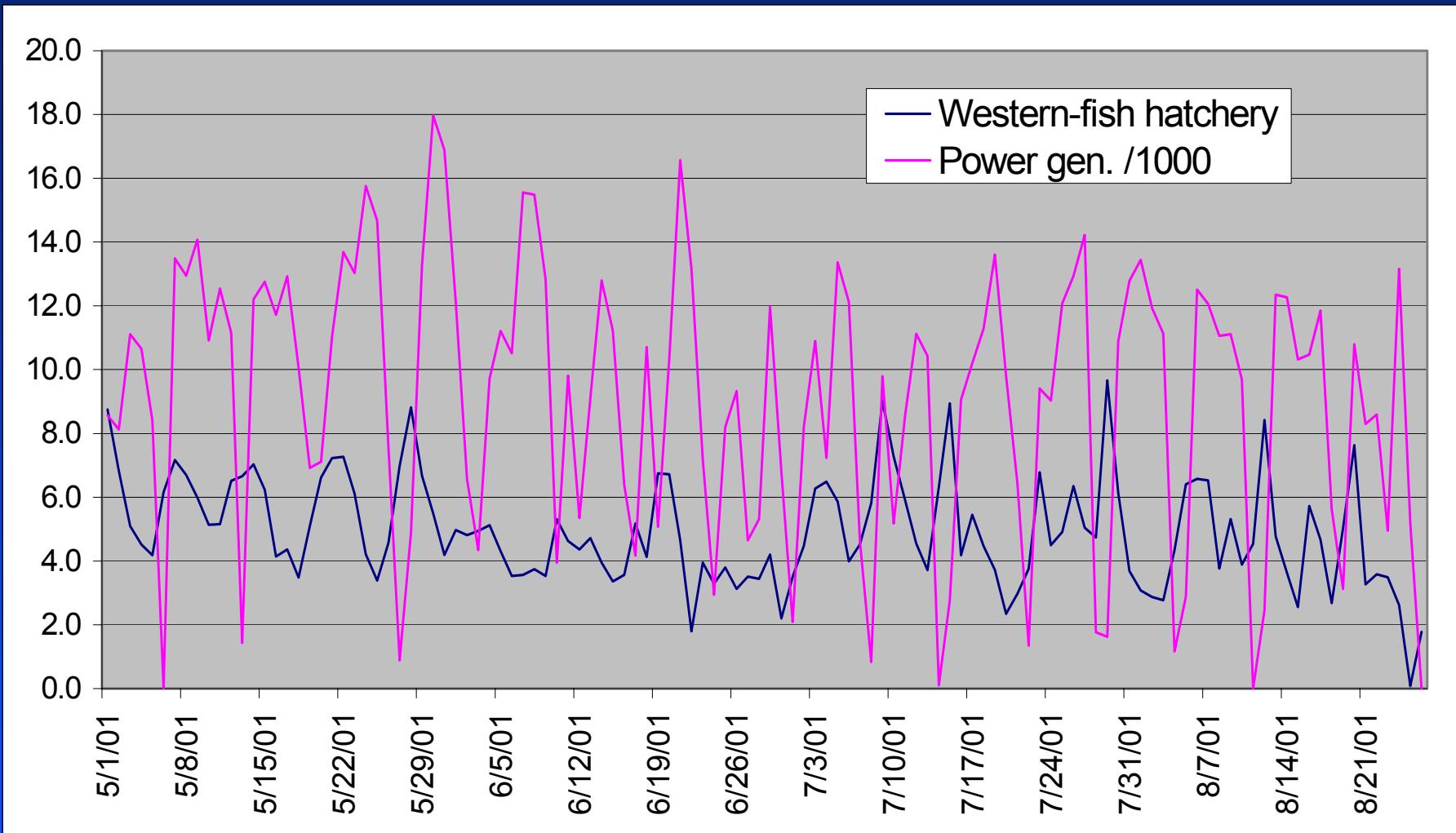




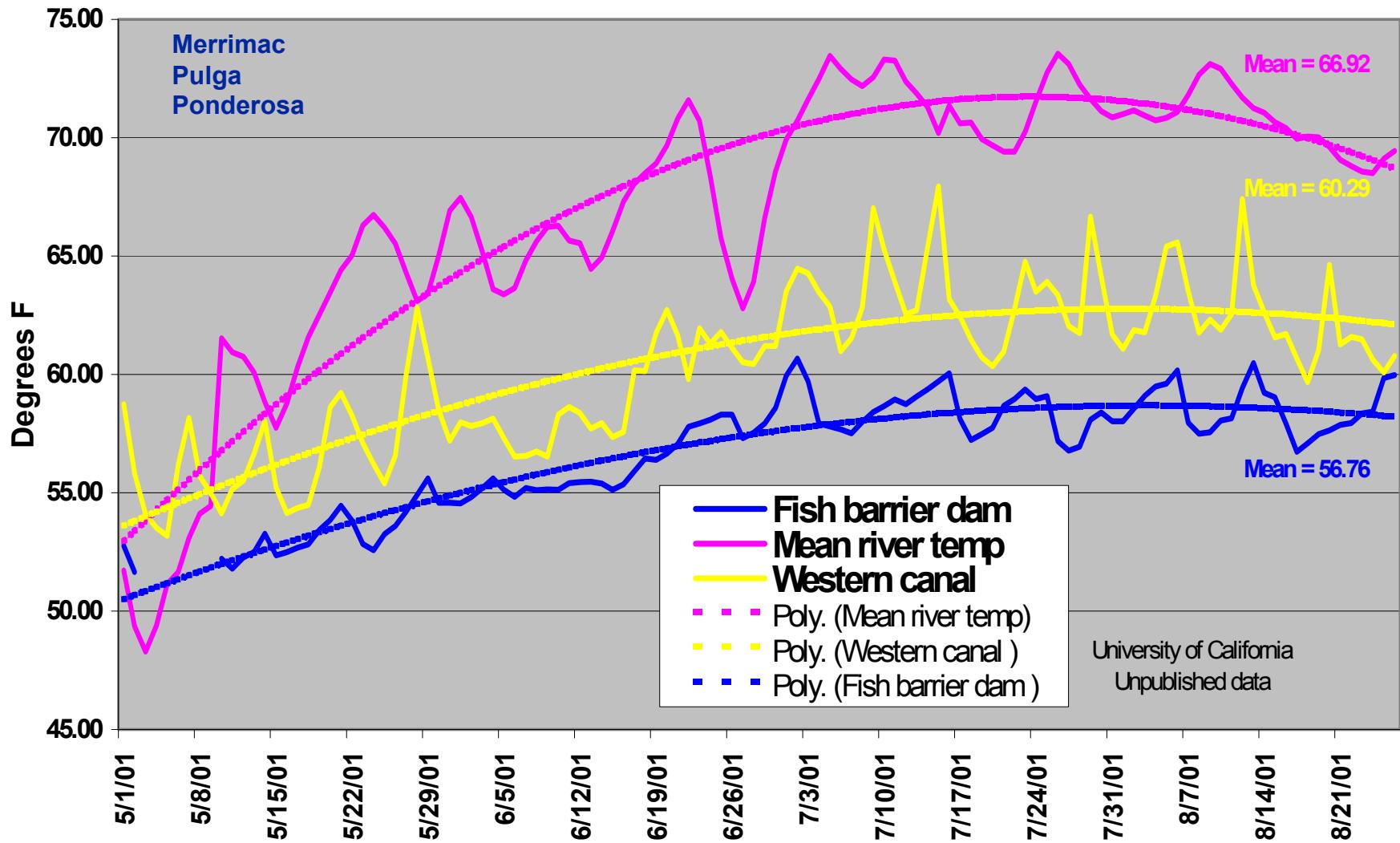
Western Canal Average Temperatures

Probe #	Planting				PI				Grain fill			
	Min	Max	Ave.		Min	Max	Ave.		Min	Max	Ave.	
1	54	58	56		62	66	64		60	63	62	
4	54	59	56		62	68	65		60	65	63	
9	55	61	58		62	69	66		61	67	64	
11	55	63	58		66	70	68		65	68	67	
15	61	71	65		70	79	74		68	74	71	

Daily water temperature and power generation rate from Oroville dam



Feather River-Western Canal Water Temperatures 2001



Average July water temperatures of Feather River at Oroville

Years	MAX	MIN
1963-1967	69.4	68.2
1970-1975	60.9	59.0
1996-2001	61.0	57.0

Conclusions

- Preliminary results indicate a mid-season threshold water temperature between 60° F and 65° F.
- Yield loss due to low water temperatures can occur even at non blanking air temperatures (<68° F).
- Remotely sensed images related well to spatial yield variability.
- Regional impact of lower water temperatures is wide spread.



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